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ABSTRACT

This 50 slide set of presentation graphs and maps illustrates some of the major conditions and trends in population, agriculture, biodiversity, forests, water resources, energy, climate, and social and economic development that determine the state of the world's environment. Graphs and maps can be used by those in academic, professional, and advocacy settings to help viewers visualize, understand, compare, and contrast information. The set is based on data collected and compiled for 176 countries by the World Resources Institute and gives a broad picture of trends over 20 years. In a few cases, future projections are presented to show possible consequences. Designed for flexible use, the set can be shown as a unit with provided commentary; or selected graphs and maps can be used for shorter presentations on a particular topic. The maps are color coded according to a rainbow scale with green as environmentally "good" and red as environmentally "poor." Where possible, subsets of data are shown for groups of countries by economic level or by geographic region. (LZ)

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GLOBAL TRENDS
IN ENVIRONMENT AND DEVELOPMENT

PRESENTATION SET

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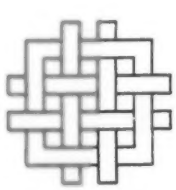

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GLOBAL TRENDS
IN ENVIRONMENT AND DEVELOPMENT

Presentation Set

This set of presentation graphs and maps was selected to illustrate some of the major conditions and trends in population, agriculture, biodiversity, forests, water resources, energy, climate, and social and economic development that determine the state of the world's environment. These data give a broad picture of trends over 20 years. Some of the trends are alarming or depressing, but others are hopeful. In a few cases, future projections are presented to show possible consequences.

Graphs and maps help us visualize, understand, compare, and contrast information, making it more meaningful. We hope these images can be used in many academic, professional, and advocacy settings to deepen the viewers' understanding and stimulate discussion about the state of the environment and human development.

The Global Trends Presentation Set is designed for flexible use. It can be shown as a unit with commentary from this booklet; or selected graphs and maps can be used for shorter presentations on a particular topic.

The maps in this presentation are color coded according to a rainbow scale with green as environmentally "good" and red as environmentally "poor;" thus, lower numbers are represented by green on some maps and red on others. Where possible, subsets of data are shown for groups of countries by economic level or by geographic region. In cases where this grouping was not appropriate or possible, data for countries that are representative of major economic and geographic areas are shown.

This presentation set is based on data collected and compiled by the World Resources Institute. The data can be found in the World Resources 1994–95 Data Base Diskette (World Resources Institute, Washington, D.C., 1994) and in *World Resources 1994–95*, a collaborative effort of the World Resources Institute, the United Nations Environment Programme and the United Nations Development Programme (World Resources Institute, Washington D.C., 1994). With data for 176 countries, this is the most comprehensive and up-to-date database of country-level data available on global environment and development conditions and trends. The original sources of the data are noted on the graphs and maps and in this booklet.

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POPULATION AND HUMAN DEVELOPMENT

1 World Population Growth

World population is expected to nearly double by 2050, from 5.7 billion in 1994 to about 10 billion people. Nearly all the growth will occur in the developing world.

Sources: United Nations Population Division (UNPD), *Long-Range World Population Projections: Two Centuries of Population Growth, 1950–2150* (UNPD, New York, 1992); and Carl Haub, Director of International Education, Population Reference Bureau, Washington, D.C., 1993 (personal communication).

2 UN Population Projections

Long-range global population projections vary dramatically depending on assumptions about several factors, one of which is fertility. If fertility stabilized at 2.5 children per couple (the "High" projection), global population could reach 28 billion in 2150. If it stabilized at 1.7 children (the "Low" projection), population would peak at 7.8 billion in 2050 but then fall to 4.3 billion 100 years later. The current average fertility rate is 3.3 (the "Medium" projection), down from 4.5 in the early 1970s.

Source: United Nations Population Division (UNPD), *Long-Range World Population Projections: Two Centuries of Population Growth, 1950–2150* (UNPD, New York, 1992).

3 Age and Sex Distribution, Developing Countries

In developing nations, young people make up a much larger share of the total population. This has important implications for future population growth in these nations as the young people reach adulthood and begin to have children of their own.

Source: United Nations Population Division (UNPD), *Sex and Age 1950–2025 (The 1992 Revision)*, on diskette (UNPD, New York, 1992). Data refer to 1990.

4 Age and Sex Distribution, Industrialized Countries

There are some striking differences in the population makeup of the developing and industrialized nations. In the industrialized nations, the population is more evenly distributed between young, middle-aged, and elderly people. Because there is not a larger number of young people entering their reproductive years, the size of this population can remain stable over time.

Source: United Nations Population Division (UNPD), *Sex and Age 1950–2025 (The 1992 Revision)*, on diskette (UNPD, New York, 1992). Data refer to 1990.

5 Total Fertility Rate

Another way of looking at growth trends is to consider fertility rates, or the average number of births per woman. As the map shows, fertility rates are very high in developing regions such as Africa and the Middle East and low in most industrialized regions, especially Europe, where some countries have fertility rates *below* the replacement level.

Source: United Nations Population Division (UNPD), *Demographic Indicators, 1950–2025 (The 1992 Revision)*, on diskette (UNPD, New York, 1993). The total fertility rate is an estimate of the number of children that an average woman would have if current age-specific fertility rates remain constant during her reproductive years. Data are the expected annual average during the 1990–95 period.

6 Population Growth Rate

It is important to consider differences in population growth rates, particularly when thinking about the future. As the map shows, population is growing most rapidly in Africa and the Middle East and has almost stabilized in Europe. If current growth rates continue, the population of Sub-Saharan Africa would double by about the year 2015, while that of Europe would increase by less than 6 percent.

Source: United Nations Population Division (UNPD), *Demographic Indicators 1950–2025 (The 1992 Revision)*, on diskette (UNPD, New York, 1993). The growth rate is the annual average between 1990 and 1995. Population doubling times are listed in the United Nations Development Programme, *Human Development Report 1993* (Oxford University Press, New York, 1993), pp. 180–181.

7 Population Density

Global population must be viewed in several ways. One way is to look at population density, or the number of people living on a given amount of land. As the map shows, the most crowded parts of the world are Asia and Europe. Africa, which has a high rate of population growth, is not densely populated.

Sources: Data on land area are from the United Nations Food and Agriculture Organization (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1993). The data are for 1991. The data on population, also for 1991, are from the United Nations Population Division (UNPD), *Interpolated National Populations (The 1992 Revision)*, on diskette (UNPD, New York, 1993).

8 Fertility Rates and Female Literacy

There is a striking relationship between female literacy and fertility rates. On the average, women who can read tend to have fewer children than women who cannot. Data such as these have encouraged population programs to stress education, training, and higher status for women as methods of slowing population growth.

Sources: United Nations Population Division (UNPD), *Demographic Indicators 1950–2025 (The 1992 Revision)*, on diskette (UNPD, New York, 1993); and United Nations Educational, Scientific, and Cultural Organization (UNESCO), *Compendium of Statistics on Illiteracy, 1990* (UNESCO, Paris, 1990). Data refer to 1990.

9 Female Literacy as a Percentage of Male Literacy

There is considerable variation in female literacy among developing regions. In many countries of Sub-Saharan Africa, the percentage of adult literate females is less than half that of adult literate males. Although literacy rates remain low, there has been striking progress in female literacy in many developing countries since 1970.

Sources: The World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 276–277; and the United Nations Children's Fund, *The State of the World's Children 1994* (Oxford University Press, New York, 1994), pp. 76–77. Data refer to 1990.

10 Contraceptive Use

Since 1960, there has been a dramatic increase in the percentage of married couples using contraception in many developing countries, especially in Latin America, East Asia, and South Asia. Contraceptive use is still relatively limited in Africa.

Source: Thomas Merrick, "U.S. Population Assistance: A Continued Priority for the 1990s?" (Population Reference Bureau, Washington, D.C. 1990), p. 17.

11 Child Mortality Rate

Many countries have made significant progress in reducing mortality of children under age 5. In Brazil, the number of deaths per 1,000 live births dropped from 181 in 1960 to 69 in 1991; in Zimbabwe during the same period, the rate declined from 181 to 90. But under-5 mortality remains high in many countries, especially in Sub-Saharan Africa. For example, in Nigeria, deaths per 1,000 live births dropped from 204 in 1960 to 191 in 1991.

Source: United Nations Children's Fund, *The State of the World's Children 1994* (Oxford University Press, New York, 1994). Data refer to 1992.

12 Daily Calories Per Capita

Per capita calorie intake remains low in much of Sub-Saharan Africa and South Asia. It is estimated that, in the 1988–90 period, a total of 786 million people were chronically undernourished, including 528 million people in Asia and 168 million people in Africa. Chronic undernutrition is declining in Asia but is increasing in Africa. The recommended daily calorie intake varies by country and culture, age and gender. However, several United Nations agencies use an average of 2,300 calories per day as the minimum acceptable for a healthy population.

Sources: The Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1993); and the World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), p. 108. Data refer to 1990.

CONSUMPTION

13 U.S. Material Consumption Trends

Consumption of many materials in the United States (shown here by weight) skyrocketed after World War II. The most striking increases are in industrial minerals (used in chemical feedstocks and fertilizers), metals, and plastics and synthetics. The use of paper (including recycled paper) has grown, but, interestingly, the use of wood has remained relatively stable. The use of nonfood agricultural products, such as cotton, wool, and tobacco, appears to have increased only slightly; however, because they are lighter in weight than some of the other substances, this chart may not reflect their true increase.

The slight decline in primary-metal consumption over the last few decades reflects increasing recycling and production from scrap. An increase in consumption of nonfuel organic material reflects the rising use of plastic, synthetic fiber in textiles and carpets, synthetic rubber, and petrochemical products.

Source: U.S. Bureau of Mines, "Materials and the Economy," *Minerals Today* (April 1993), p. 15, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), p. 15.

14 Fossil Fuel Consumption Per Capita

Since the first oil price shock of the mid-1970s, per capita consumption of fossil fuels has declined moderately in industrialized countries but has risen in developing countries. Per capita consumption in industrialized countries is still very high and remains about nine times greater than in developing countries.

Sources: United Nations Statistical Division (UNSTAT), *U.N. Energy Tape* (UNSTAT, New York, 1992); and United Nations Population Division (UNPD), *Interpolated National Populations (The 1992 Revision)*, on diskette (UNPD, New York, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), p. 8. Data are five-year averages.

15 Aluminum Consumption Per Capita

Per capita consumption of aluminum has grown in both industrialized and developing countries. In the industrialized world, it is still much higher (by a factor of 20) than in the developing world.

Sources: World Bureau of Metal Statistics (WBMS), *World Metal Statistics Yearbook, 1992* (WBMS, Ware, U.K., 1992); and Metallgesellschaft Aktiengesellschaft, *Metallstatistik 1961–71* and *Metallstatistik 1970–80* (Metallgesellschaft A.G., Frankfurt, Germany, 1972 and 1981), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 8–9. Data are five-year averages.

16 Roundwood Consumption Per Capita

Global per capita roundwood consumption has grown slightly, with the level in industrialized countries remaining approximately 2.5 times that of developing countries. (Roundwood refers to any wood felled or harvested from trees, regardless of its final use (e.g., wood products, paper, or fuelwood).

Sources: Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1992); and United Nations Population Division (UNPD), *Interpolated National Populations (The 1992 Revision)*, on diskette (UNPD, New York, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 10–11. Data are five-year averages.

17 Beef Consumption Per Capita

Per capita consumption of beef and veal in developing countries has stayed about the same, while there has been a slight downward trend in industrialized countries. Consumption per capita is about six times higher in industrialized countries than in developing countries.

Sources: Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1992); United Nations Population Division (UNPD), *Interpolated National Populations (The 1992 Revision)*, on diskette (UNPD, New York, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 11–12. Data are five-year averages.

ECONOMICS

18 Per Capita Gross Domestic Product

Measured in terms of per capita gross domestic product, there is an enormous gap in income between the industrialized countries and the developing countries. For example, Japan's per capita income is about 93 times greater than India's.

Source: The World Bank, unpublished data (The World Bank, Washington, D.C., November 1993).

19 Distribution of GDP by Sector

Historically, as countries have developed, the base of their economic wealth has shifted from agriculture to industry and services. Agriculture is a small share of the economies of industrialized countries such as the United States and Japan; the great bulk of economic activity is in industry and services. Agriculture's share of GDP is declining in nearly all developing countries, but in many cases the share is still significant. In India and Nigeria, for example, agriculture still accounts for about one-third of GDP and most of the jobs.

Source: The World Bank, *World Tables 1993*, on diskette (The World Bank, Washington, D.C., 1993). See also The World Bank, *World Development 1993* (Oxford University Press, New York, 1993), pp. 242–243. Data refer to 1991.

20 Prices for Selected Commodities

Many developing countries with agriculture-based economies rely on the export of agricultural commodities to earn money. However, in recent years, the prices of most agricultural commodities have declined, leaving many countries with less income than expected. Exporters of coffee and cocoa, for example, have suffered sharply declining prices since the mid-1980s. The world price of sugar in 1992 was only about one-fifth of the 1975 level.

Source: The World Bank, unpublished data (The World Bank, Washington, D.C., August 1993).

LAND USE AND COVER

21 Land Cover, 1700 and 1980

The most dramatic change in global land use has been the expansion of cropland and the reduction of forestland. From 1700 to 1980, it is estimated that the world's forest and woodland declined nearly 20 percent from roughly 6.2 billion hectares to 5.1 billion hectares. Over the same period, cropland increased about 460 percent from about 270 million hectares to about 1.5 billion hectares (1,000 hectares is approximately 4 square miles).

Source: John F. Richards, "Land Transformation," in *The Earth as Transformed by Human Action*, B.L. Turner, William C. Clark, Robert W. Kates, *et al.*, eds. (Cambridge University Press, Cambridge and New York, 1990), p. 164.

22 Human Disturbance of Vegetated Land

Data on human disturbance have been extracted from data from various global, country, and regional atlases; maps of human and livestock population densities, land use, and forest cover; desertification estimates; and other sources portraying human infrastructure, development, and vegetation cover.

Areas of *low human disturbance* are covered by natural vegetation and/or have a population density under 10 people per square kilometer or under 1 person per square kilometer in arid, semiarid, and tundra regions.

Areas of *medium human disturbance* are under shifting or extensive agriculture, and/or contain secondary, naturally regenerating vegetation; have a livestock density exceeding their carrying capacity; exhibit other evidence of human disturbance (e.g., contain a logging concession); or otherwise do not fit into the other two disturbance categories.

Areas of *high human disturbance* are under permanent agricultural cultivation or urban settlement, and/or contain primary vegetation removed without evidence of regrowth; contain current vegetation differing from potential vegetation; have a record of desertification or other permanent degradation.

The underlying data vary considerably in quality, and viewers should be aware that areas of low human disturbance are likely overrepresented due to dated or inaccurate information.

Source: Lee Hannah, unpublished data (Conservation International, Washington, D.C., 1993); as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 150–151.

23 Megacities, 2000

The world will become increasingly urban in the next few decades. This trend will be most marked in the developing nations, which will increasingly dominate the list of the world's largest cities. In the year 2000, 13 of the 21 megacities (cities with more than 10 million people) will be in Asia. Only two will be in the United States and none will be in Europe.

Source: United Nations Population Division (UNPD), *Urban Agglomerations, 1950–2010 (The 1992 Revision)*, on diskette (UNPD, New York, 1993).

SOILS

24 Areas of Concern for Soil Degradation

Of the world's 1.2 billion hectares with moderate, severe, and extreme soil degradation, the largest areas are in Asia (453 million hectares) and Africa (321 million hectares). Most of this soil degradation is caused by water and wind erosion re-

sulting from agricultural activities, overgrazing, deforestation, and fuelwood collection. Central America has the highest percentage and the worst degrees of soil degradation, mainly caused by deforestation and overgrazing.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), p. 117, as adapted from the International Soil Reference and Information Centre, unpublished map (Wageningen, the Netherlands, 1990).

25 Causes of Soil Degradation

The causes of soil degradation are about equally divided among unsustainable livestock grazing, agriculture, and forestry practices. Some degradation is caused by overexploitation for fuelwood collection. A small amount (1 percent) is degraded by industrial activities, such as waste disposal and excessive pesticide use. As shown in the small pie charts, the causes of soil degradation vary by region.

Source: L.R. Oldeman, V.W.P. van Engelen, and J.H.M. Pulles, "The Extent of Human-Induced Soil Degradation," Annex 5 of L.R. Oldeman, R.T.A. Hakkeling, and W.G. Sombroek, *World Map of the Status of Human-Induced Soil Degradation: An Explanatory Note*, rev. 2nd ed. (International Soil Reference and Information Centre, Wageningen, the Netherlands, 1990), Figure 5, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), p. 114.

FOOD AND AGRICULTURE

26 Index of Per Capita Food Production

For the world as a whole, per capita food production increased about 4 percent between 1961 and 1992. Food production in Asia has increased substantially faster than population growth. In Africa, however, production has not kept pace with population: between 1980–82 and 1990–92 overall production increased 22 percent, but per capita production fell 5 percent.

Source: Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1993).

Note: Base year of index data altered by World Resources Institute, 1994.

27 Cereal Yield Per Hectare

Over the past three decades, cereal yields have shown impressive growth in most regions. The main exception is Africa, where yields have stayed about the same. On a global average, 1 hectare yielded about 2.76 metric tons of cereals in 1990–92, but 1 hectare in Africa yielded only 1.17 metric tons. Differences in yields may be due to differences in agricultural systems, soil, climate, economic incentives, or amounts of agricultural inputs.

Source: The Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1993).

28 Cropland Per Capita

Worldwide, the amount of cropland per capita has declined over the past 30 years because of rapid population growth. However, higher yielding crops have continued to increase food production; thus, less land is required to produce food. Asia's per capita cropland is only about half the world average and is shrinking. North and Central America and the former U.S.S.R. still have substantially more cropland per capita than other regions of the world.

Sources: Food and Agriculture Organization of the United Nations (FAO), *Agrostat PC*, on diskette (FAO, Rome, 1993); and United Nations Population Division (UNPD), *Interpolated National Populations (The 1992 Revision)*, on diskette (UNPD, New York, 1993).

FORESTS AND BIODIVERSITY

29 Annual Deforestation, 1981–90

Between 1980 and 1990, tropical forest areas have been shrinking on average 15.4 million hectares (0.8 percent) per year. The Asia and Pacific region, which has less remaining forest than other tropical regions, has the highest average annual deforestation rate (1.2 percent), followed by South America and the Caribbean (0.8 percent) and Africa (0.7 percent).

Source: Food and Agriculture Organization of the United Nations (FAO), *Forest Resources Assessment 1990: Tropical Countries*, FAO Forestry Paper 112 (FAO, Rome, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 130–131.

30 Protected Areas

Currently, about 6 percent of the world's land area is either strictly or partially protected. North and Central America have set aside the highest percentage of land in parks and reserves while the countries of the former Soviet Union have set aside the least, just over 1 percent. The World Conservation Union has set a target of protecting 10 percent of each of the world's major biomes by the year 2000.

Source: World Conservation Monitoring Centre (WCMC), unpublished data (WCMC, Cambridge, U.K., 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 152–153.

31 Centers of Plant Diversity

The World Conservation Union has identified 241 centers of plant diversity. If protected, these areas could protect the majority of wild plants in the world. There are three types of sites: "botanically rich sites that can be defined geographically;" "geographically defined regions with high species diversity and/or endemism;" and "vegetation types and floristic provinces that are exceptionally rich in plant species." Most of the sites selected so far are in the tropics.

Source: World Conservation Monitoring Centre, *Global Biodiversity: Status of the Earth's Living Resources* (Chapman and Hall, London, 1992), pp. 157–160.

32 Endemic Bird Areas

About 27 percent of the world's bird species have relatively small ranges of less than 50,000 square kilometers. These restricted range areas tend to be grouped on islands or in isolated areas of a particular habitat. The International Council for Bird Preservation has identified 221 endemic bird areas, which include 95% of the birds with small ranges.

Source: World Conservation Monitoring Centre, *Global Biodiversity: Status of the Earth's Living Resources* (Chapman and Hall, London, 1992), p. 161.

33 Species Extinction Estimates for Tropical Closed-Canopy Forests

At deforestation rates of 15 million hectares per year, it is estimated that 6 percent to 14 percent of all tropical closed-forest species could be lost by the year 2015 and 17 percent to 35 percent could be lost by the year 2040. If tropical deforestation slowed to 10 million hectares per year, 9 percent to 19 percent of tropical closed-forest species could be lost by 2040.

Source: Tropical Deforestation and Species Extinction, T.C. Whitmore and J.A. Sayer, eds. (Chapman and Hall, London, 1992), pp. 62–63.

34 Known Causes of Animal Extinctions Since 1600

A World Conservation Union analysis of animal extinctions since 1600 found that where the cause was known, 39 percent of extinctions had resulted from species introductions, 36 percent from habitat destruction, and 23 percent from hunting and deliberate extermination. Although the analysis focuses on island species, it is generally agreed that these factors, particularly species introduction and habitat loss, are major threats to biodiversity everywhere.

Source: World Conservation Monitoring Centre, Global Biodiversity: Status of the Earth's Living Resources (Chapman and Hall, London, 1992), p. 199, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, World Resources 1994–95 (Oxford University Press, New York, 1994), p. 149.

WATER RESOURCES

35 Major World Watersheds

The land area drained by a river and its tributaries—known as a watershed or river basin—is the basic unit for understanding the sources and effects of freshwater pollution as well as the ecological relationships between terrestrial and aquatic systems.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), pp. 164–165.

36 U.S. Upstream vs. Coastal Pollution Sources

More than half the nitrogen and phosphorus in U.S. coastal waters originates from upstream sources. These data underscore the importance of considering pollution sources in the entire watershed when dealing with coastal pollution.

Source: National Oceanic and Atmospheric Administration (NOAA) and U.S. Environmental Protection Agency Team on Near Coastal Waters, *Strategic Assessment of Near Coastal Waters*, 4 Vols. (NOAA, Washington, D.C., 1989–91). Point sources of water pollution are those that can be traced to a specific location and controlled (e.g., pipes carrying municipal or industrial wastewater). Nonpoint sources are broad sources of pollution that cannot be easily pinpointed (e.g., pesticide or fertilizer runoff from farmland).

37 Water Use Per Capita

Of the roughly 41,000 cubic kilometers of renewable freshwater resources available each year, about 3,240 cubic kilometers (644 cubic meters per person) is withdrawn for human use, including agricultural, industrial, and residential. Worldwide, about 69 percent of water consumption is for agriculture, while 23 percent is for industry and 8 percent is for domestic use. In Africa, Asia, and South America, agriculture is the primary use; for example, Asia uses 86 percent of its water for agriculture, mainly for irrigation. Water withdrawals have been increasing 4 percent to 8 percent per year, with most of that increase occurring in developing countries.

Source: Belyaev, V., Institute of Geography, U.S.S.R. National Academy of Sciences, Moscow, September 1989 and January 1990 (personal communication). Data are for 1987.

38 World Marine Fish Catch

The global marine fish catch has declined from its 1989 peak. The catch had increased since the 1950s when more powerful fishing boats, electronic fishfinding gear, and bigger nets were used by more and more fishing operations. (The small dip in the early 1970s was caused by an El Niño event.) The early 1990s saw the collapse of several traditionally rich fisheries such as Georges Bank (Atlantic cod and haddock) and the Pacific northeast (pollock). The decline of the Soviet fishing fleet following the breakup of the Soviet Union may be partially responsible for the lower world catch.

Source: Food and Agriculture Organization of the United Nations (FAO), unpublished data, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 183–194.

ENERGY

39 World Fossil Fuel Consumption

The industrialized world's share of fossil fuel consumption has declined to less than 50 percent of the world total. Meanwhile, consumption has risen in developing countries by a factor of 4 over 30 years and in the former planned economies by a factor of 2.4.

Source: United Nations Statistical Division (UNSTAT), *U.N. Energy Tape*, (UNSTAT, New York, 1992), as cited in World Resources Insti-

tute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 7–8. Data are for five-year averages.

40 Commercial Energy Consumption Per Capita

Since the first oil price shock in the mid-1970s, per capita consumption of fossil fuels has declined moderately in industrialized countries but has risen rapidly in developing countries. Industrial country per capita levels are still very high (by a factor of 9) relative to those of the developing world.

Source: United Nations Statistical Division (UNSTAT), U.N. Energy Tape, (UNSTAT, New York, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 7–8.

41 Mix of Fuel Types

Fossil fuels supply the bulk of energy worldwide. Traditional fuels such as fuelwood and dung are important in developing countries such as India and China. Renewables such as solar and wind energy are beginning to show up in the fuel mix of the United States. *Renewables* include hydroelectric, geothermal, and wind energy. *Traditional* fuels include bagasse, fuelwood, and vegetable wastes. *Fossil* fuels include coal, oil, natural gas, and small amounts of other fuels.

Source: United Nations Statistical Division (UNSTAT), *U.N. Energy Tape*, (UNSTAT, New York, 1993), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 165–167. Data refer to 1991.

42 Commercial Energy Use by Sector

The amount of energy used by various sectors of the economy differs greatly among countries. In China, for example, the industrial sector was by far the biggest energy user.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), pp. 318–319.

43 Energy Intensity

Energy intensity is the amount of energy it takes to produce US$1 of gross domestic product (GDP). Comparing the energy intensities of countries with comparable GDPs is a way of measuring how efficiently each uses energy. For example, Japanese industry used only 5 megajoules to produce US$1 of GDP while U.S. industry required 12 megajoules. Among the three major developing countries shown, China is the least energy efficient because of its use of coal in relatively inefficient boilers. Since 1989, however, China's energy efficiency has improved significantly.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), Table 21.3. Data refer to 1989.

ATMOSPHERE AND CLIMATE

44 How the Greenhouse Effect Works

The "greenhouse effect" refers to the phenomenon by which the Earth's atmosphere traps infrared radiation, or heat. Gases that cause the greenhouse effect are for the most part natural compounds—water vapor, carbon dioxide, methane, and nitrous oxide—that keep the Earth habitable.

Scientist have recently found that the release of excess greenhouse gases from burning fossil fuels, burning vegetation to clear land, and various agricultural practices could force the atmosphere to become warmer than it would otherwise. Most climate experts believe that global mean temperatures will likely rise at a rate of 0.5° Fahrenheit (0.3° centigrade) per decade if current emissions trends continue. At this rate, temperatures would rise about 1.8° F (1° C) by 2025 and 5.4° F (3° C) before the end of the next century.

It is difficult to predict the exact rate of warming because the greenhouse effect is influenced by a number of natural phenomena having to do with ocean circulation and cloud formation that are not well understood. Recent research confirms the complexity of the climate system. For example, new findings on the role of local air pollution and ozone depletion in moderating the greenhouse effect have lowered computer projections of the rate of global warming.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 203–204.

45 Atmospheric CO_2 Concentrations

Although many uncertainties surround the science of climate change, it is clear that the concentration of carbon dioxide (CO_2) in the atmosphere has increased sharply since industrialization from 289 parts per million (ppm) in 1860 to 350 ppm in 1990.

Source: Intergovernmental Panel on Climate Change (IPPC), *Climate Change: The IPCC Scientific Assessment*, J.T. Houghton, G.J. Jenkins, and J.J. Ephraums, eds. (Cambridge University Press, Cambridge, U.K., 1990), p. xvi, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), p. 5.

46 Temperature Change and Carbon Dioxide Levels Over 160,000 Years

Based on analyses of air trapped in a core sample of ice from Antarctica, a record of atmospheric carbon dioxide (CO_2) concentrations 160,000 years into the past has been constructed. This record can be related to estimates of average global temperatures for the same period. The very warm interglacial period of 130,000 years ago was accompanied by CO_2 levels of just under 300 parts per million (ppm), while concentrations during the previous great Ice Age dropped to around 200 ppm. (Current atmospheric CO_2 levels are about 350 ppm.)

Source: Intergovernmental Panel on Climate Change, *Climate Change: The IPCC Scientific Assessment* (Cambridge University Press, New

York, 1990). See also World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1990–91* (Oxford University Press, New York, 1990), pp. 12–13.

47 Cumulative Emissions of Carbon Dioxide from Fossil Fuels, 1950–89

This graph shows the 10 countries that have emitted the most carbon dioxide (CO_2)from burning fossil fuels over the past 40 years. The United States is clearly in the lead, followed by the former U.S.S.R. and the European Union countries.

Source: Carbon Dioxide Information Analysis Center (CDIAC), Oak Ridge National Laboratory, unpublished data (CDIAC, Oak Ridge, Tennessee, 1989), as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1992–93* (Oxford University Press, New York, 1992), p. 206.

48 Top Ten Greenhouse Gas Emitters

Although carbon dioxide (CO_2) from fossil fuel burning is the major greenhouse gas, there are other sources of CO_2 and other greenhouse gases. Estimates here of national greenhouse gas emissions are based on anthropogenic sources of CO_2 (as calculated from data on fossil fuel combustion, cement manufacture, and deforestation), methane (from data on landfills, coal extraction, oil and gas production, wet rice agriculture, and livestock production), and the two main chlorofluorocarbons (CFC-11 and CFC-12).

Using the method proposed by the Intergovernmental Panel on Climate Change (IPCC), emission estimates for each gas are combined with another factor, the global warming potential, to give an overall index of each country's contribution to the increase in the warming potential of the atmosphere in a given year.

This graph shows the 10 countries with the highest emissions of all greenhouse gases for one year. The United States and former U.S.S.R. are still in the lead with China replacing the European Union in third place.

Source: World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), p 201. Data refer to 1991.

About WRI

The World Resources Institute (WRI) is a policy research center created in late 1982 to help governments, international organizations, and private business address a fundamental question: How can societies meet basic human needs and nurture economic growth while preserving the natural resources and environmental integrity on which life, economic vitality, and international security depend?

The Institute's current areas of policy research include forests, biological diversity, sustainable agriculture, energy, climate change, atmospheric pollution, economic incentives for sustainable development, and resource and environmental information.

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49 Seven Megacities with the Worst Air Pollution

The World Health Organization (WHO) and the United Nations Environment Programme joined forces in 1992 to publish a study of air pollution in 20 of the world's 24 megacities (urban areas with more than 10 million people now or by the year 2000). Every city studied had at least one major pollutant that exceeded WHO guidelines, 14 cities had at least two, and 7 cities had at least three.

Of the cities for which there are sufficient data to compare, Mexico City has the worst overall air pollution—serious levels of sulfur dioxide (SO_2), suspended particulate matter (SPM), carbon monoxide (CO), and tropospheric ozone (O_3); and heavy levels of lead (Pb) and nitrogen oxide (NO_2).

Source: World Health Organization and the United Nations Environment Programme, *Urban Air Pollution in Megacities of the World* (Blackwell Reference, Oxford, U.K., 1992), p. 39, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme, *World Resources 1994–95* (Oxford University Press, New York, 1994), pp. 198–199.

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